CAIT

Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

Project Title:	Automated Pedestrian Counter
RFP NUMBER: 2008-06	NJDOT RESEARCH PROJECT MANAGER: **Vincent Nichnadowicz**
TASK ORDER NUMBER: TO 217 / RU Acct 4-27252	PRINCIPAL INVESTIGATOR: Dr. Kaan Ozbay/Ranjit Walia
Project Starting Date: 01/01/2008 **Original** Project Ending Date: 12/31/2009 **Modified Completion Date:**	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Literature Search	9.04%	$ 15,000	0.00%	$ -	100.00%	$ 15,000
1	Task 1: Comprehensive Literature Review & Policy Analysis	12.06%	$ 20,000	0.00%	$ -	100.00%	$ 20,000
2	Task 2: Selection of Pedestrian Counters	4.52%	$ 7,500	0.00%	$ -	100.00%	$ 7,500
3	Task 3: Select Deployment Sites	3.32%	$ 5,500	0.00%	$ -	100.00%	$ 5,500
4	Task 4: Develop Evaluation Plan	12.42%	$ 20,600	0.00%	$ -	100.00%	$ 20,600
5	Task 5: Implement Evaluation Plan	35.68%	$ 59,192	50.00%	$ 29,596	80.00%	$ 47,354
6	Task 6: Develop Recommendations & Guidelines	17.32%	$ 28,723	30.00%	$ 8,617	40.00%	$ 11,489
7	Task 7: Project Management, Final & Quarterly Reports	5.64%	$ 9,361	0.00%	$ -	65.00%	$ 6,085
	TOTAL	100.00%	$ 165,876		$ 38,213		$ 133,527

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Green text is updated ever quarter
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Project Objectives:

Objective 1: Scanning

Step 1. Assess current state-of-the art in pedestrian sensors

a. Conduct literature review related to the pedestrian counters

b. Develop and conduct interviews with a number of States

c. Develop Recommendations

Objective 2: PILOT STUDY

Step 2. Develop experimental set-up

i. In close cooperation with NJDOT, select pedestrian counters to be tested.

ii. In close cooperation with NJDOT, select sites where field tests will be implemented.

Step 3. Develop an evaluation plan

Step 4. Implement the evaluation plan

i. Conduct field tests

ii. Analyze data

Step 5. Interpret results of the field evaluation

Objective 3: SYNTHESIS

Step 1. Develop recommendations and guidelines

Project Abstract:

NJDOT needs to collect **accurate** pedestrian related information in a **cost effective way**. According to the RFP issued by NJDOT, there are key gaps for pedestrian planning and mobility including the "*number of pedestrians using any given sidewalk, path, crosswalk, or other pedestrian facilities*". The lack of such data is in turn clearly one of the one of the most significant barriers to the development of *safety conscious transportation plans* that includes pedestrians as well as vehicles. The same RFP states two important types of information needed for reliable decision-making:

1. better understanding of pedestrian behavior,
2. more accurate and complete inventory of pedestrian flow rates.

In the past, pedestrian count information was generally collected manually. However, since the manual collection of accurate pedestrian counts can be quite expensive and time-consuming, this approach is used sporadically and as a result does not yield comprehensive data from which to make informed policy and planning decisions. In fact, because of extensive time and labor requirements of manual

data collection, which might also be relatively inaccurate, reliable pedestrian flow information is most of the time not available to the planners and decision makers. In addition to the lack of meaningful pedestrian flow data, other information related to the understanding of "pedestrian behavior" is almost never available. Unfortunately, even the literature is quite limited in terms of this information. Most recently, researchers at the UC Berkeley Safety Center conducted a comprehensive feasibility study along with a pilot test to assess the best ways to collect both types of information namely, flow and behavior (Greene-Roesel et al., 2007). One of the main findings if their report is the fact that automated counters are the most feasible way of collecting pedestrian data that is reliable and statistically significant in terms of its sample size. In turn, this study provides support for the need to assess the feasibility and use of automated pedestrian counters in New Jersey. Such data could fill a key information gap for the lack of this information which is one of the key parts of the overall puzzle for decision makers and planners who would like to consider pedestrian oriented multi-modal transportation options when developing their planning projects.

With the advent of new technologies that make it possible to automatically count and even track pedestrians in a wide variety of settings and transportation facilities, accurate and cost effective data collection has become a possibility. The major goals of this project as also stated in the original RFP can be summarized as follows:

1. Conduct a literature review on this topic and scope out the costs and feasibility of utilizing these technologies in NJ.
2. Create a pilot program where a limited number of automated pedestrian counters are purchased, deployed and field evaluated.
3. Assess the ease of use and value of the data to help the department to make better decisions about the feasibility of "using automated pedestrian counters" at a larger scale in the State.
4. Develop comprehensive yet easy to use guidelines for the deployment of various types of automated counters under various site-specific conditions
5.

1. Progress this quarter by task:

Phase 1- Literature Search: This task is completed.

Phase 2 - Research

Task 1 Comprehensive Review and Policy Analysis:

1. We completed Task 1. We delivered a final report for Task 1 (combined with the findings of Literature Search of Phase 1).

This task is complete.

Task 2 Select and Recommend Pedestrian Counters To Be Evaluated[1]:

1. After a meeting with NJDOT project team and presenting them with the selected counters, the research team decided to acquire two sensors approved by the NJDOT research panel, one for high volume and one for low volume intersections.
2. The purchase orders for both detectors are completed and they are ordered in the fourth quarter. Now, the research team is awaiting for the delivery of the two detectors with an anticipated delivery date of early December. These sensors are:
    a. High Volume: Thermal camera
    b. Low Volume: Eco-Twin + Pyro electric sensor

Two sensors namely, EcoCounter and Thermal camera are selected and purchased. This task is complete.

Task 3 Select Deployment Sites:

This task is completed.

Task 4 Develop a Comprehensive Evaluation Plan

This task is completed.

Task 5 Implement Evaluation Plan

We conducted the field evaluation of the "high volume scenario" at two locations that were selected as part of the previous tasks. The first location was in New Brunswick and the second one was near the Trenton train station. Prior to the installation of the thermal sensor at these locations, several site visits were made to collect preliminary data regarding the best location of the sensor in terms of pedestrian movements and the physical infrastructure. At New Brunswick and Trenton locations pedestrian data

[1] This report is being prepared in May 27th 2009 and some of the tasks are in anticipation of what is expected to happen in June, 2009.

was collected on May 13th, 2009 and May 22nd 2009, respectively, using the thermal camera and video camera. We have also deployed the EcoCounter at the same locations to be able to compare accuracy of both sensors. Regular video recordings were than processed at the lab by students to obtain ground truth data. These manual recordings are then compared to sensor recording to determine the magnitude and type of errors by both sensors.

Next step is to conduct rigorous statistical analysis of data obtained from both sensors and determine the need for further data collection. Based on this analysis, the research team decided to collect additional data using the thermal counter for a shorter time period, approximately 2 hours, at the New Brunswick location to eliminate some of the errors due to the location of the sensor. This will be done during the week of June 1st latest.

Another data collection and processing task is to use the video recordings to understand human errors when manual data collection is conducted. This will be done for several hours for both locations. The results of this type of data collection will then be compared with sensor data and ground truth data.

Tasks 6: Develop Recommendations and Guidelines

The results of the data collection along with the results of the statistical analysis is being used to develop technical guidelines for the collection, processing, and analysis of data obtained using two different types sensors and manual data collection. These guidelines are unique because they will provide steps to minimize errors caused by different sensor types, levels of pedestrian traffic, and locations. Moreover, we are working on the development of recommendations for the deployment of specific sensors given the needs of the department as well time and resource constraints.

Task 7 Project Management, Final and Quarterly Reports

This is an on-going task that includes all the project management and reporting activities required by the project.

2. Proposed activities for next quarter by task:

Tasks 5, 6, and 7: Tasks 5 and 6 will be completed. A draft final report will be prepared and delivered for review.

3. List of deliverables provided in this quarter by task (product date):

1. A presentation of the findings of during the previous quarter

4. Progress on Implementation and Training Activities:

1. An on-site training for the installation and the calibration of the thermal camera is scheduled with the manufacturer of the thermal pedestrian counter" is set up for March 5th, 2009.

5. Problems/Proposed Solutions:

We encountered a problem with finding a suitable power source for the thermal counter. This was a problem because the current power source needed to be altered to be compatible with the voltage required by the thermal counter and this had a cost of $2000. Thus, we decided to use batteries as an alternative that is less expensive and more portable. A steel box that can accommodate both these batteries were ordered. The original New Brunswick location also required permission from the owner of the traffic light and that might cause further delays. We decided to first test the equipment at a less problematic more accessible location namely at the same Busch campus location where we tested the EcoCounter. This location has several advantages 1) the permit for installation the equipment on the pole has already been obtained 2) it has quite a high volume of pedestrian traffic 3) it has been used for the testing of the EcoCounter, thus we will have a chance to compare both sensors under similar pedestrian traffic conditions 4) it is easily accessible by allowing the team to test if the battery based power solution works adequately or not.

Year 1 Budget	$ 97,455
Years 1 & 2 Cumulative Budget	$165,876
Years 1, 2 & 3 Cumulative Budget	
Total Project Budget	$165,876
Modified Contract Amount:	
Total Project Expenditure to date	$133,527
% of Total Project Budget Expended	80.50%

NJDOT Research Project Manager Concurrence: _____ Date: _____

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QUARTERLY PROGRESS REPORT

Project Title:	Evaluation of the Automated Distress Survey Equipment
RFP NUMBER: 2008-07	NJDOT RESEARCH PROJECT MANAGER: Vincent Nichnadowicz
TASK ORDER NUMBER: TO 224 / RU Acct 4-23382	PRINCIPAL INVESTIGATOR: Carl Rascoe
Project Starting Date: 05/01/2008 **Original** Project Ending Date: 07/31/2009 **Modified Completion Date:**	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Conduct Literature Search	2.11%	$ 3,000.00	0.00%	$ -	100.00%	$ 3,000
2	Prepare Distress Identification Manual	9.27%	$ 13,170.00	0.00%	$ -	100.00%	$ 13,170
3	Select Test Sections	24.71%	$ 35,100.00	0.00%	$ -	100.00%	$ 35,100
4	Vendor Selection	5.29%	$ 7,518.00	0.00%	$ -	100.00%	$ 7,518
5	Field Data Collection and Data Analyses	44.96%	$ 63,850.00	10.00%	$ 6,385	80.00%	$ 51,080
6	Quarterly and Final Reports	13.65%	$ 19,387.00	15.00%	$ 2,908	60.00%	$ 11,632
7		0.00%	$ -	0.00%	$ -	0.00%	$ -
8		0.00%	$ -	0.00%	$ -	0.00%	$ -
9		0.00%	$ -	0.00%	$ -	0.00%	$ -
10		0.00%	$ -	0.00%	$ -	0.00%	$ -
11		0.00%	$ -	0.00%	$ -	0.00%	$ -
12		0.00%	$ -	0.00%	$ -	0.00%	$ -
13		0.00%	$ -	0.00%	$ -	0.00%	$ -
14		0.00%	$ -	0.00%	$ -	0.00%	$ -
15		0.00%	$ -	0.00%	$ -	0.00%	$ -
16		0.00%	$ -	0.00%	$ -	0.00%	$ -
17		0.00%	$ -	0.00%	$ -	0.00%	$ -
18		0.00%	$ -	0.00%	$ -	0.00%	$ -
19		0.00%	$ -	0.00%	$ -	0.00%	$ -
20		0.00%	$ -	0.00%	$ -	0.00%	$ -
	TOTAL	100.0%	$ 142,025		$ 9,293		$ 121,500

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Project Objectives:

Since there are multiple vendors with this type of equipment, the Department would like to evaluate and compare these units in a side-by-side pilot for the next generation Pavement Management System data collection vehicle. The evaluation of the Automated Distress Survey Equipment to supplement or replace the current manual visual distress data collection could significantly improve the quality and repeatability of the PMS distress data and help the Department make better pavement rehabilitation decisions. This is especially important in this time of limited financial resources.

The objectives of this research study are to:

- Evaluate the capabilities, limitations, and repeatability of the various automated distress survey equipment technologies on various distress types on different pavement surfaces types at various distress severity levels, lighting conditions and highway speeds.
- Assess the capabilities, limitations, and repeatability of the Department's PMS rater staff on various distress types on different pavement surfaces types at various distress severity levels, lighting conditions and highway speeds.
- Assess the level of effort and time required to process the images from the automated distress survey equipment
- Determine which types of distress are better collected with the automated distress survey equipment and which distress types should continue to be collected by PMS staff.
- Determine how the data collected by the automated distress data collection equipment can be incorporated into the pavement management system.

Project Abstract:

In order to address the research objectives, the research team will conduct a comprehensive literature search to summarize the manufacture's description of the distress data collection technology and other research conducted to assess the current state-of-the-art in pavement imaging and distress identification and evaluation. The research team will meet with the PMS staff to identify 15 one-mile test sections that have a variety of pavement types (BC, CO, and RC), distress types, severity levels and extents. The team will review the Department's current distress survey protocol and develop distress definitions, and evaluation criteria for use in the research study. Based on the content of the literature search and experience of the research team, a number of automated distress survey equipment vendors representing the various distress collection technologies will be identified. These vendors will be contracted to collect three runs on each test sites in one day and conduct analyses of the image data at NJ DOT.

The PMS staff will also collect distress data using the current protocol. The testing order of the test sites will be randomly assigned. The distress type, severity and extent levels of each site will be documented for comparison between the automated distress survey equipment and the PMS raters.

Progress this quarter by task:

1. The CAIT team worked with the Dynatest team and Kelvin Wang (Waylink) to prepare the cracking data from the distress data on the test sites. The data was delivered and analyzed. The CAIT team is conducting statistical analyses of the relationship between the datasets.
2. A draft final report is being prepared. This will be finalized when the statistical analysis is complete.
3. The Dynatest team and Kelvin Wang (Waylink) met with CAIT and NJDOT to discuss their data collection and processing. The image data was delivered.

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4. Proposed activities for next quarter by task:

The draft final report will be completed and delivered to NDJOT for review.
The CAIT research team will develop a methodology for utilizing the automated distress data into the Department's SDI_m.

3. List of deliverables provided in this quarter by task (product date):

4. Progress on Implementation and Training Activities:

5. Problems/Proposed Solutions:

Year 1 Budget	$142,025
Years 1 & 2 Cumulative Budget	
Years 1, 2 & 3 Cumulative Budget	
Total Project Budget	$142,025
Modified Contract Amount:	
Total Project Expenditure to date	$121,500
% of Total Project Budget Expended	85.5%

NJDOT Research Project Manager Concurrence: _____ Date: _____

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QUARTERLY PROGRESS REPORT

Project Title:	Self Cleaning and De-Polluting Geopolymer Coatings for Graffiti Prevention and Removal-Demo Project
RFP NUMBER: 200X-XXX	NJDOT RESEARCH PROJECT MANAGER: Robert Sasor
TASK ORDER NUMBER: TO 211 / RU Acct 4-28959	PRINCIPAL INVESTIGATOR: Dr. P. Balaguru
Project Starting Date: 10/15/2007 **Original** Project Ending Date: 10/15/2008 **Modified Completion Date: 10/15/09**	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Literatuare Search	5.12%	$ 5,123	0.00%	$ -	100.00%	$ 5,123
2	Self Cleaning & Depolluting Study	28.00%	$ 28,000	15.00%	$ 4,200	90.00%	$ 25,200
3	Coating Color & Field Application -A-	6.00%	$ 6,000	0.00%	$ -	95.00%	$ 5,700
4	Coating Color and Field Application -B-	6.00%	$ 6,000	0.00%	$ -	100.00%	$ 6,000
5	Graffiti Removal Method	24.50%	$ 24,500	10.00%	$ 2,450	60.00%	$ 14,700
6	Geopolymer Cost Estimate	1.50%	$ 1,500	0.00%	$ -	0.00%	$ -
7	Compare Geopolymer to Other Coatings	3.50%	$ 3,500	0.00%	$ -	0.00%	$ -
8	Develop Generic Specification	3.00%	$ 3,000	5.00%	$ 150	5.00%	$ 150
9	Field Demostration of Graffiti Removal	5.00%	$ 5,000	0.00%	$ -	60.00%	$ 3,000
10	Monitor Coating Long Term	6.00%	$ 6,000	20.00%	$ 1,200	50.00%	$ 3,000
11	Final Re[prt and Quarterly Reporting	8.88%	$ 8,877	0.00%	$ -	0.00%	$ -
12	Training and Implementation Plan	2.50%	$ 2,500	0.00%	$ -	20.00%	$ 500
13		0.00%	$ -	0.00%	$ -	0.00%	$ -
14		0.00%	$ -	0.00%	$ -	0.00%	$ -
15		0.00%	$ -	0.00%	$ -	0.00%	$ -
16		0.00%	$ -	0.00%	$ -	0.00%	$ -
17		0.00%	$ -	0.00%	$ -	0.00%	$ -
18		0.00%	$ -	0.00%	$ -	0.00%	$ -
19		0.00%	$ -	0.00%	$ -	0.00%	$ -
20		0.00%	$ -	0.00%	$ -	0.00%	$ -
	TOTAL	100.00%	$ 100,000		$ 8,000		$ 63,373

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100 Brett Rd. Piscataway NJ 08854-8058
Tel: 732-445-0579 Fax: 732-445-3325

Project Objectives:
The primary objective of the proposed study is to demonstrate the effectiveness of the inorganic coating for graffiti prevention and removal. Since other formulations are available in the market, the study will have the following components.

(1) Field demonstration of the inorganic coating for graffiti prevention and removal, and

(2) Cost comparison of this coating with other available products, for both initial application and maintenance, based on the cost for graffiti removal.

In addition, laboratory and field studies will be conducted to document properties pertaining to:

(3) Self cleaning, and

(4) De-pollution.

Project Abstract:
A site has been selected for the demonstration application and testing of graffiti removal. It is a retaining wall located on a ramp from Route 1 North to the Woodbridge Mall. The wall is about 200 feet long and has an average height of about 7 feet and is easily accessible. Since the surface to be coated faces a parking lot, traffic control is not needed and sufficient space is available for both application of the coating and tests for graffiti removal. The wall and four concrete boards will be coated with the inorganic coating. Two concrete boards will be brought to the laboratory for evaluating the most efficient graffiti removal techniques and for studying self cleaning and de-pollution properties. The other two concrete boards will be kept outside the lab to test for outdoor exposure.

In addition, a specification will be prepared for using the geopolymer coating as an anti-graffiti, self cleaning and de-polluting surface treatment. A performance and cost comparison study between this coating material and other commercially available products will also be conducted.

1. Progress this quarter by task:
More laboratory and field tests were conducted for self cleaning and more laboratory tests were conducted for de-pollution studies. We are also monitoring the coatings.

2. Proposed activities for next quarter by task:
Evaluate steam for graffiti removal techniques
Continue the self cleaning and de-pollution study.

3. List of deliverables provided in this quarter by task (product date):
None

4. Progress on Implementation and Training Activities:
None

5. Problems/Proposed Solutions:

Year 1 Budget	$58,123
Years 1 & 2 Cumulative Budget	$100,000
Years 1, 2 & 3 Cumulative Budget	
Total Project Budget	$100,000
Modified Contract Amount:	
Total Project Expenditure to date	$ 63,373
% of Total Project Budget Expended	63.37%

NJDOT Research Project Manager Concurrence: _____ Date: _____

CAIT

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QUARTERLY PROGRESS REPORT

Project Title:	Dynamic Modulus of Hot Mix Asphalt
RFP NUMBER: 2003-10	NJDOT RESEARCH PROJECT MANAGER: Camille Crichton-Sumners
TASK ORDER NUMBER: TO 199 / RU Acct 4-26619	PRINCIPAL INVESTIGATOR: Ali Maher/Thomas Bennert
Project Starting Date: 01/01/2007 **Original** Project Ending Date: 12/31/2008 **Modified Completion Date:** 6/30/2009	Period Covered: 2nd Quarter 2009-FINAL

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Mobilization	11.19%	$ 25,000	0.0%	$ -	100.0%	$ 25,000
2	Literature Search	2.24%	$ 5,000	0.0%	$ -	100.0%	$ 5,000
3	Develop Test Plan	2.24%	$ 5,000	0.0%	$ -	100.0%	$ 5,000
4	Conduct E* Testing and Database Development	26.85%	$ 60,000	0.0%	$ -	100.0%	$ 60,000
5	Compare Measured E* to Predicted E*	8.43%	$ 18,835	0.0%	$ -	100.0%	$ 18,835
6	Conduct Sensitivity Analysis of E*	15.66%	$ 35,000	0.0%	$ -	100.0%	$ 35,000
7	Conduct Round Robin Testing	11.24%	$ 25,117	0.0%	$ -	100.0%	$ 25,117
8	Develop Final Database	7.83%	$ 17,500	0.0%	$ -	100.0%	$ 17,500
9	Final Report and Quarterly Reporting	14.32%	$ 32,032	5.0%	$ 1,602	100.0%	$ 32,032
10		0.00%	$ -	0.0%	$ -	0.0%	$ -
11		0.00%	$ -	0.0%	$ -	0.0%	$ -
12		0.00%	$ -	0.0%	$ -	0.0%	$ -
13		0.00%	$ -	0.0%	$ -	0.0%	$ -
14		0.00%	$ -	0.0%	$ -	0.0%	$ -
15		0.00%	$ -	0.0%	$ -	0.0%	$ -
16		0.00%	$ -	0.0%	$ -	0.0%	$ -
17		0.00%	$ -	0.0%	$ -	0.0%	$ -
18		0.00%	$ -	0.0%	$ -	0.0%	$ -
19		0.00%	$ -	0.0%	$ -	0.0%	$ -
20		0.00%	$ -	0.0%	$ -	0.0%	$ -
	TOTAL	100.00%	$ 223,484		$ 1,602		$ 223,484

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Project Objectives:

The objective of the research project is to provide the NJDOT with a clear understanding of the dynamic modulus test and it precision, the typical E* values of their native HMA materials, and the accuracy of the prediction equations that are proposed for use in the MEPDG.

Project Abstract:

The most critical parameter needed for the upcoming Mechanistic Empirical Pavement Design Guide (MEPDG) is the dynamic modulus (E*), which will be used for flexible pavement design. The dynamic modulus represents the stiffness of the asphalt material when tested in a compressive-type, repeated load test. The dynamic modulus will be the key parameter used to evaluate both rutting and fatigue cracking. The computer software that will accompany the MEPDG will provide general default parameters for the dynamic modulus. However, caution has already been issued by the National Cooperative Highway Research Program (NCHRP) researchers as to the appropriateness of these parameters for regional areas. The major concern is that state agencies will use these default values blindly and sacrifice accuracy of the design. Hence, making the new mechanistic procedure no better than using a structural number (SN) with the old AASHTO method.

To ensure that the New Jersey Department of Transportation (NJDOT) will be prepared for the upcoming design procedure, a research proposal has been developed. The research proposal will encompass evaluating the dynamic modulus of approximately twenty different hot mix asphalt designs that are currently specified by the NJDOT. The dynamic modulus will be determined based on the most current testing protocol (AASHTO TP62). The dynamic modulus (E*) will be represented using a technique called a *master curve*. The E* master curve is a single curve that represents the asphalt materials stiffness relationship to loading frequency and temperature. The master curve for each material tested will be developed and its sigmoidal curve fitting parameters (α, β, γ, δ) determined. This procedure is called Level I for the MEPDG and will provide the most realistic results during design. The measured E* values will be compared to that of the Witczak predictive equation and the Hirsch model. The Witczak predictive equation has been selected by the NCHRP researchers for the Level II and III design. The Level II will provide accurate results, although not as accurate as actually measuring the E* in the laboratory. The predictive equation is based on the mix gradation, asphalt binder viscosity properties, and volumetric properties of the hot mix asphalt. The accuracy of the predictive equation will be determined, as well as possible methods to "shift" the predictive equation to more closely represent New Jersey materials.

Another important aspect of the research project is the development of a "precision-type statement" for use by the NJDOT regarding the dynamic modulus test. Currently, a precision statement does not exist regarding multiple laboratories. Eight laboratories were contacted and asked to participate in a round robin study regarding the dynamic modulus test. All laboratories are AMRL accredited for hot mix asphalt and will provide valuable information regarding the expected precision the NJDOT can expect if dynamic modulus testing is to be conducting by outside laboratories.

1. Progress this quarter by task:

Draft final report has been generated and will be provided to the NJDOT at the June Quarterly meeting.

2. Proposed activities for next quarter by task:

Complete final report for submittal.

3. List of deliverables provided in this quarter by task (product date):
NA

4. Progress on Implementation and Training Activities:
NA

5. Problems/Proposed Solutions:
NA

Year 1 Budget	$223,484
Years 1 & 2 Cumulative Budget	
Years 1, 2 & 3 Cumulative Budget	
Total Project Budget	$223,484
Modified Contract Amount:	
Total Project Expenditure to date	$223,484
% of Total Project Budget Expended	100%

NJDOT Research Project Manager Concurrence: _____ Date: _____

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QUARTERLY PROGRESS REPORT

Project Title:	New Jersey State LTAP Technology Transfer Center (FHWA) 2009
RFP NUMBER:	NJDOT RESEARCH PROJECT MANAGER: W. Lad Szalaj
TASK ORDER NUMBER: TO 230 / Acct 4-30745	PRINCIPAL INVESTIGATOR: Dr. Ali Maher
Project Starting Date: 01/01/2009 **Original** Project Ending Date: 12/31/2009	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Mobilization		$ -	0.00%	$ -	0.00%	$ -
2	Safety Focus Area	30.50%	$ 73,264	30.00%	$ 21,979	70.00%	$ 51,285
3	Infrastructure Management Focus Area	28.10%	$ 67,289	30.00%	$ 20,187	60.00%	$ 40,373
4	Workforce Development Focus Area	23.00%	$ 55,290	25.00%	$ 13,823	45.00%	$ 24,881
5	Organizational Excellence	18.40%	$ 44,157	25.00%	$ 11,039	50.00%	$ 22,079
6		0.00%	$ -	0.00%	$ -	0.00%	$ -
7		0.00%	$ -	0.00%	$ -	0.00%	$ -
8		0.00%	$ -	0.00%	$ -	0.00%	$ -
9		0.00%	$ -	0.00%	$ -	0.00%	$ -
10		0.00%	$ -	0.00%	$ -	0.00%	$ -
11		0.00%	$ -	0.00%	$ -	0.00%	$ -
12		0.00%	$ -	0.00%	$ -	0.00%	$ -
13		0.00%	$ -	0.00%	$ -	0.00%	$ -
14		0.00%	$ -	0.00%	$ -	0.00%	$ -
15		0.00%	$ -	0.00%	$ -	0.00%	$ -
16		0.00%	$ -	0.00%	$ -	0.00%	$ -
17		0.00%	$ -	0.00%	$ -	0.00%	$ -
18		0.00%	$ -	0.00%	$ -	0.00%	$ -
19		0.00%	$ -	0.00%	$ -	0.00%	$ -
20		0.00%	$ -	0.00%	$ -	0.00%	$ -
	TOTAL	100.00%	$ 240,000		$ 67,028		$ 138,618

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

Project Objectives:

The New Jersey Local Technical Assistance Program (LTAP) has a mission to become an information clearinghouse to foster a safe, efficient, environmentally sound transportation system by improving the skills and knowledge of the transportation industry through technology transfer activities, such as training, technical assistance and dissemination of resources.

The objectives of this project are to continue to diversify and expand the customer base, deliver quality customer service, communicate the program values to partners and clients, and enhance the technology transfer network, through the activities of the New Jersey Local Technical Assistance Program (LTAP).

Project Abstract:

The Center for Advanced Infrastructure and Transportation (CAIT), located at Rutgers University, is submitting this proposal for the continuation of the New Jersey Local Technical Assistance Program (NJ LTAP). NJ LTAP will conduct technology transfer activities that include the dissemination of information through a monthly newsletter, conducting training programs, and administering clearinghouse activities. This ongoing effort provides public works, engineering, planning, and law enforcement employees with training and information in the areas of design, maintenance, inspection, supervision, employee development, and other transportation related subjects. NJ LTAP will also support and provide services to the transportation research community in cooperation with the New Jersey Department of Transportation.

Recently, FHWA has revised the LTAP/TTAP focus areas and performance measures to better reflect a continuous cycle of improvement. Performance measures, formerly known as tasks, will be used in 2009 to assess safety, workforce development, infrastructure management, and organizational excellence. This approach will provide an opportunity to continually reassess the customer base and value in each focus area.

Center Name: New Jersey Local Technical Assistance Program
Reporting Period: April 1, 2009 to June 30, 2009

Program Dashboard

Total number of training sessions:	**39**
Total number of participants:	**1,936**
Total number of participant hours:	**9,913**
Total newsletter circulation:	**11,454**
Total number of LTAP/TTAP FTEs:	**2.5**

Training Data

Safety

The Safety metric is divided into 2 categories: Highway Safety and Worker/Workplace Safety. Count the training your center conducted or had responsibility for conducting, such as training co-sponsored with a partner.

Highway and Worker Safety

Session Name	Session Length [hours]	Total # of Sessions	Total # of participants					Total # of Participants	Total Participant Hours
			Local	Tribal	State	Federal	Other		
Work Zone Safety Awareness Program	6	2			26		23	49	294
Crash Data Records Technician Training	5	4	70					70	350
Traffic Control Coordinator Program	32	2			25		15	40	1,280
Traffic Control Coordinator Refresher Workshop	4	2					60	60	240
Police Work Zone Safety Train the Trainer (MUTCD)	6	2	35					35	210
Police Work Zone	6	2	32					32	192

Safety Train the Trainer (NJ Vs. MUTCD)									
Police Work Zone Safety Train the Trainer (DOT Specs)	6	2	38					38	228
Police Work Zone Safety Train the Refresher)	6	3	41					41	246
Work Zone Safety Week Workshops	4	4	72		40		40	152	698
Work Zone Safety Leadership Conference	4	1			46	1	53	100	400
Teen Driver Education Forum	5	1	316		21		39	376	1,880
TOTAL	**84**	**25**	**463**		**158**	**2**	**231**	**993**	**6,018**

Infrastructure Management

Session Name	Session Length [hours]	Total # of Sessions	Total # of participants					Total # of Participants	Total Participant Hours
			Local	Tribal	State	Federal	Other		
Pipe Operations Safety	6	1	27					27	162
Bridge Connection Details and Design	4	1	6					6	24
The Mini Bridge: Intro to Culvert Planning and Design	6	1	24					24	144
NJ Municipal Stormwater Permit Changes	3.5	1	28					28	98
Pavement Maintenance: Crack Treatment Seminar	6	1	25					25	150
Roundabout Design	12	1	3				9	12	144
Electrical Signal Design	6	1	5				8	13	78
NJTPA Plan 2035	2	1			6		45	51	102
Traffic Signal Warrants at Intersections Near Railroad-Highway Crossings	2	1			5		60	65	130
New Jersey Transit Signal Priority	2	1					48	48	96
TOTAL	**47.5**	**9**	**118**		**5**		**125**	**289**	**1,128**

Workforce Development

Session Name	Session Length [hours]	Total # of Sessions	Total # of participants					Total # of Participants	Total Participant Hours
			Local	Tribal	State	Federal	Other		
Preventing Sexual Harassment and Other Hostile Behaviors in the Workplace	4	1	28					28	112
Construction Career Day	5	2					500	500	2,500
American Recovery and Reinvestment Act of 2009	1	1			9		88	97	97
NJDOT/PennDOT Smart Transportation Guidebook	2	1			1		28	29	58
TOTAL	**12**	**5**	**28**		**10**		**616**	**654**	**2,767**

Newsletter / Published Resources Data

Circulation

Name of Newsletter	Circulation				
	Local	Tribal	State	Federal	Other
LTAP E-News	1,961	7	920	161	764

Number of Articles per Focus Area

Newsletter Issue	Safety			Workforce Development	Infrastructure Management
	Highway	Worker	Work Zone		
Volume 11, Number 04	1	1		4	1
Volume 11 Number 05	1			2	2
Volume 11, Number 06	1	1	1	1	2

Materials Distribution Data

Material Types	Safety			Workforce Development	Infrastructure Management
	Highway	Worker	Work Zone		
Publications	214		1,652	500	168
CDs	376				
Videotapes					
DVDs					
Downloads					
Others [insert]					
TOTAL:					

Technical Assistance Data

Estimate the total percentage of time spent by your Center staff providing technical assistance during the past quarter: **40%**

Activities Related to Program Stakeholders

Organization	Activities					
	# of times center distributed information for this organization (mail, e-mail, fax, etc.)	# of joint training sessions	# of joint conferences	# of joint special programs	# of articles reprinted in LTAP/TTAP newsletters from this organization	# of center staff participating in national program efforts
National Stakeholders						
FHWA (HQ, Resource Center)	**7**				**3**	**2**
AASHTO					**1**	**1**
NACE	**2**				**2**	**1**
APWA	**3**				**5**	**1**
TRB						**1**
Salt Institute						**1**

State/Local Stakeholders						
FHWA Division						**2**
State DOT/govt	**2**	**6**				**3**
AASHTO Chapter						
NACE Chapter						**1**
APWA Chapter	**3**			**1**		**1**
ITE	**4**					**2**
Other Stakeholders						
NJ Society of Municipal Engineers				**1**		**2**
NJ Div of Highway Traffic Safety	**7**		**1**		**1**	**2**
NJ Asphalt Pavement Assoc.	**3**					**1**
NJ WZS Partnership		**10**	**1**			**2**

1. Progress this quarter by task, with specific deliverables:

A. Safety Focus Area

25 Workshops
2,242 Resources Distributed

B. Infrastructure Management Focus Area

9 Workshops
168 Resources Distributed

C. Workforce Development Focus Area

5 Workshops
500 Resources Distributed

D. Organizational Excellence

New Jersey Police Traffic Officers Association Meeting	April 1, 2009
American Public Works Association Education Summit	April 2-3, 2009
NLTAPA Executive Committee Meeting	April 7, 2009
Work Zone Safety Leadership Event	April 9, 2009
NLTAPA Safety Work Group Conference Call	April 13, 2009
APWA NJ Chapter Executive Board Meeting	April 15, 2009
NJ Association of County Engineers Meeting	April 17, 2009
Annual New Jersey Public Works Equipment Exposition Exhibit	April 21, 2009
Metropolitan Section, Institute of Transportation Engineers Mtg.	April 22, 2009
New Jersey Construction Career Day	April 23-24, 2009
NLTAPA Conference Committee Conference Call	April 30, 2009
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New Jersey Society of Municipal Engineers Meeting	June 3, 2009
NLTAPA Safety Work Group Conference Call	June 8, 2009
NLTAPA Executive Committee Meeting	June 15, 2009
APWA NJ Chapter Executive Board Meeting	June 17, 2009
NJ Society of Asphalt Technologists Meeting	June 17, 2009
New Jersey LTAP Stakeholder Meeting	June 19, 2009
Council of University Transportation Centers Summer Meeting	June 30-July 2, 2009
Course/Workshop Evaluations	Ongoing
Technical Assistance	Ongoing

2. Progress on Implementation and Training Activities:

All of the activities of this technology transfer project, and their implementation dates are included above.

Year 1 Budget	$240,000
Total Project Budget	$240,000
Modified Contract Amount:	$
Total Project Expenditure to date	$138,618
% of Total Project Budget Expended	57.76%

NJDOT Research Project Manager Concurrence: _____ Date: _____

CAIT
Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

Project Title:	New Jersey State LTAP Technology Transfer Center (STATE) 2009
RFP NUMBER:	NJDOT RESEARCH PROJECT MANAGER: W. Lad Szalaj
TASK ORDER NUMBER: TO 230 / Acct 4-30761	PRINCIPAL INVESTIGATOR: Dr. Ali Maher
Project Starting Date: 01/01/2009 **Original** Project Ending Date: 12/31/2009 **Modified Completion Date:**	Period Covered: 2nd Quarter 2009

Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
Mobilization		$ -	0.00%	$ -	0.00%	$ -
Safety Focus Area	25.00%	$ 10,000	30.00%	$ 3,000	70.00%	$ 7,000
Infrastructure Management Focus Area	25.00%	$ 10,000	30.00%	$ 3,000	60.00%	$ 6,000
Workforce Development Focus Area	25.00%	$ 10,000	25.00%	$ 2,500	45.00%	$ 4,500
Organizational Excellence	25.00%	$ 10,000	25.00%	$ 2,500	50.00%	$ 5,000
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%		0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
	0.00%	$ -	0.00%	$ -	0.00%	$ -
TOTAL	100.00%	$ 40,000		$ 11,000		$ 22,500

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Black text is automatically updated or static

Project Objectives:

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The objectives of this project are to continue to diversify and expand the customer base, deliver quality customer service, communicate the program values to partners and clients, and enhance the technology transfer network, through the activities of the New Jersey Local Technical Assistance Program (LTAP).

Project Abstract:

The Center for Advanced Infrastructure and Transportation (CAIT), located at Rutgers University, is submitting this proposal for the continuation of the New Jersey Local Technical Assistance Program (NJ LTAP). NJ LTAP will conduct technology transfer activities that include the dissemination of information through a monthly newsletter, conducting training programs, and administering clearinghouse activities. This ongoing effort provides public works, engineering, planning, and law enforcement employees with training and information in the areas of design, maintenance, inspection, supervision, employee development, and other transportation related subjects. NJ LTAP will also support and provide services to the transportation research community in cooperation with the New Jersey Department of Transportation.

Recently, FHWA has revised the LTAP/TTAP focus areas and performance measures to better reflect a continuous cycle of improvement. Performance measures, formerly known as tasks, will be used in 2009 to assess safety, workforce development, infrastructure management, and organizational excellence. This approach will provide an opportunity to continually reassess the customer base and value in each focus area.

Center Name: New Jersey Local Technical Assistance Program
Reporting Period: April 1, 2009 to June 30, 2009

Program Dashboard

Total number of training sessions:	**39**
Total number of participants:	**1,936**
Total number of participant hours:	**9,913**
Total newsletter circulation:	**11,454**
Total number of LTAP/TTAP FTEs:	**2.5**

Training Data

Safety

The Safety metric is divided into 2 categories: Highway Safety and Worker/Workplace Safety. Count the training your center conducted or had responsibility for conducting, such as training co-sponsored with a partner.

Highway and Worker Safety

Session Name	Session Length [hours]	Total # of Sessions	Total # of participants					Total # of Participants	Total Participant Hours
			Local	Tribal	State	Federal	Other		
Work Zone Safety Awareness Program	6	2			26		23	49	294
Crash Data Records Technician Training	5	4	70					70	350
Traffic Control Coordinator Program	32	2			25		15	40	1,280
Traffic Control Coordinator Refresher Workshop	4	2					60	60	240
Police Work Zone Safety Train the Trainer (MUTCD)	6	2	35					35	210
Police Work Zone Safety Train the	6	2	32					32	192

Trainer (NJ Vs. MUTCD)									
Police Work Zone Safety Train the Trainer (DOT Specs)	6	2	38					38	228
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Teen Driver Education Forum	5	1	316		21		39	376	1,880
TOTAL	**84**	**25**	**463**		**158**	**2**	**231**	**993**	**6,018**

Infrastructure Management

Session Name	Session Length [hours]	Total # of Sessions	Total # of participants					Total # of Participants	Total Participant Hours
			Local	Tribal	State	Federal	Other		
Pipe Operations Safety	6	1	27					27	162
Bridge Connection Details and Design	4	1	6					6	24
The Mini Bridge: Intro to Culvert Planning and Design	6	1	24					24	144
NJ Municipal Stormwater Permit Changes	3.5	1	28					28	98
Pavement Maintenance: Crack Treatment Seminar	6	1	25					25	150
Roundabout Design	12	1	3				9	12	144
Electrical Signal Design	6	1	5				8	13	78
NJTPA Plan 2035	2	1			6		45	51	102
Traffic Signal Warrants at Intersections Near Railroad-Highway Crossings	2	1			5		60	65	130
New Jersey Transit Signal Priority	2	1					48	48	96
TOTAL	**47.5**	**9**	**118**		**5**		**125**	**289**	**1,128**

Workforce Development

Session Name	Session Length [hours]	Total # of Sessions	Total # of participants					Total # of Participants	Total Participant Hours
			Local	Tribal	State	Federal	Other		
Preventing Sexual Harassment and Other Hostile Behaviors in the Workplace	4	1	28					28	112
Construction Career Day	5	2					500	500	2,500
American Recovery and Reinvestment Act of 2009	1	1			9		88	97	97
NJDOT/PennDOT Smart Transportation Guidebook	2	1			1		28	29	58
TOTAL	**12**	**5**	**28**		**10**		**616**	**654**	**2,767**

Newsletter / Published Resources Data

Circulation

Name of Newsletter	Circulation				
	Local	Tribal	State	Federal	Other
LTAP E-News	1,961	7	920	161	764

Number of Articles per Focus Area

Newsletter Issue	Safety			Workforce Development	Infrastructure Management
	Highway	Worker	Work Zone		
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Volume 11 Number 05	1			2	2
Volume 11, Number 06	1	1	1	1	2

Distribution Data

Material Types	Safety			Workforce Development	Infrastructure Management
	Highway	Worker	Work Zone		
Publications	214		1,652	500	168
CDs	376				
Videotapes					
DVDs					
Downloads					
Others [insert]					
TOTAL:					

Technical Assistance Data

Estimate the total percentage of time spent by your Center staff providing technical assistance during the past quarter: **40%**

Activities Related to Program Stakeholders

Organization	Activities					
	# of times center distributed information for this organization (mail, e-mail, fax, etc.)	# of joint training sessions	# of joint conferences	# of joint special programs	# of articles reprinted in LTAP/TTAP newsletters from this organization	# of center staff participating in national program efforts
National Stakeholders						
FHWA (HQ, Resource Center)	**7**				**3**	**2**
AASHTO					**1**	**1**
NACE	**2**				**2**	**1**
APWA	**3**				**5**	**1**
TRB						**1**
Salt Institute						**1**

State/Local Stakeholders						
FHWA Division						**2**
State DOT/govt	**2**	**6**				**3**
AASHTO Chapter						
NACE Chapter						**1**
APWA Chapter	**3**			**1**		**1**
ITE	**4**					**2**
Other Stakeholders						
NJ Society of Municipal Engineers				**1**		**2**
NJ Div of Highway Traffic Safety	**7**		**1**		**1**	**2**
NJ Asphalt Pavement Assoc.	**3**					**1**
NJ WZS Partnership		**10**	**1**			**2**

1. Progress this quarter by task, with specific deliverables:

A. Safety Focus Area

25 Workshops
2,242 Resources Distributed

B. Infrastructure Management Focus Area

9 Workshops
168 Resources Distributed

C. Workforce Development Focus Area

5 Workshops
500 Resources Distributed

D. Organizational Excellence

New Jersey Police Traffic Officers Association Meeting	April 1, 2009
American Public Works Association Education Summit	April 2-3, 2009
NLTAPA Executive Committee Meeting	April 7, 2009
Work Zone Safety Leadership Event	April 9, 2009
NLTAPA Safety Work Group Conference Call	April 13, 2009
APWA NJ Chapter Executive Board Meeting	April 15, 2009
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New Jersey Construction Career Day	April 23-24, 2009
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Rutgers Univ. Transportation Coordinating Council Meeting	May 5, 2009
NLTAPA Safety Work Group Conference Call	May 11, 2009
APWA NJ Chapter Executive Board Meeting	May 13, 2009
Annual LTAP Region One Meeting	May 19-20, 2009
NLTAPA Conference Committee Conference Call	May 28, 2009
New Jersey Society of Municipal Engineers Meeting	June 3, 2009
NLTAPA Safety Work Group Conference Call	June 8, 2009
NLTAPA Executive Committee Meeting	June 15, 2009
APWA NJ Chapter Executive Board Meeting	June 17, 2009
NJ Society of Asphalt Technologists Meeting	June 17, 2009
New Jersey LTAP Stakeholder Meeting	June 19, 2009
Council of University Transportation Centers Summer Meeting	June 30-July 2, 2009
Course/Workshop Evaluations	Ongoing
Technical Assistance	Ongoing

2. Progress on Implementation and Training Activities:

All of the activities of this technology transfer project, and their implementation dates are included above.

Year 1 Budget	$40,000
Total Project Budget	$40,000
Modified Contract Amount:	$
Total Project Expenditure to date	$22,500.00
% of Total Project Budget Expended	56.25%

NJDOT Research Project Manager Concurrence: _____ Date: _____

CAIT
Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

Project Title:	In Place Rehabilitation of Pipes Using Polymer Composites: Demo Project
RFP NUMBER: 2008-IMP-005	NJDOT RESEARCH PROJECT MANAGER: Robert Sasor
TASK ORDER NUMBER: TO 233 / RU Acct 4-30744	PRINCIPAL INVESTIGATOR: Perumalsamy Balaguru
Project Starting Date: 11/17/2008 **Original** Project Ending Date: 11/17/2010 **Modified Completion Date:**	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Completion of Demo Project	75.00%	$ 22,000	5.00%	$ 1,100	10.00%	$ 2,200
2	Report on Performance	20.00%	$ 7,000	0.00%	$ -	0.00%	$ -
3	Quarterly and Final Reporting	5.00%	$ 1,360	0.00%	$ -	0.00%	$ -
4		0.00%	$ -	0.00%	$ -	0.00%	$ -
5		0.00%	$ -	0.00%	$ -	0.00%	$ -
6		0.00%	$ -	0.00%	$ -	0.00%	$ -
7		0.00%	$ -	0.00%	$ -	0.00%	$ -
8		0.00%	$ -	0.00%	$ -	0.00%	$ -
9		0.00%	$ -	0.00%	$ -	0.00%	$ -
10		0.00%	$ -	0.00%	$ -	0.00%	$ -
11		0.00%	$ -	0.00%	$ -	0.00%	$ -
12		0.00%	$ -	0.00%	$ -	0.00%	$ -
13		0.00%	$ -	0.00%	$ -	0.00%	$ -
14		0.00%	$ -	0.00%	$ -	0.00%	$ -
15		0.00%	$ -	0.00%	$ -	0.00%	$ -
16		0.00%	$ -	0.00%	$ -	0.00%	$ -
17		0.00%	$ -	0.00%	$ -	0.00%	$ -
18		0.00%	$ -	0.00%	$ -	0.00%	$ -
19		0.00%	$ -	0.00%	$ -	0.00%	$ -
20		0.00%	$ -	0.00%	$ -	0.00%	$ -
	TOTAL	100.00%	$ 30,360		$ 1,100		$ 2,200

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

Project Objectives:

To rehabilitate two clay pipes using composites

Project Abstract:

New Jersey Department of Transportation manages a number of transportation structures that have pipes of various sizes that act as culverts. It is a challenge to repair and rehabilitate pipes with

diameters less than 36 inches because of the problems of accessibility. An innovative solution is needed for in-place repairing these pipes.

1. Progress this quarter by task:
Continued literature survey on repairing pipes that are about 24 in. diameter.

2. Proposed activities for next quarter by task:
Complete some repair in the lab for simulation.

3. List of deliverables provided in this quarter by task (product date):
None

4. Progress on Implementation and Training Activities:
None

5. Problems/Proposed Solutions:
None

Total Project Budget	$30,360
Modified Contract Amount:	
Total Project Expenditure to date	$2,200
% of Total Project Budget Expended	7.25%

NJDOT Research Project Manager Concurrence: _____ Date: _____

CAIT

Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

Project Title:	Stormwater System Monitoring and Evaluation
RFP NUMBER: 2007-10	NJDOT RESEARCH PROJECT MANAGER: Edward Kondrath
TASK ORDER NUMBER: TO 200 / RU Acct 4-28300	PRINCIPAL INVESTIGATOR: Dr. Qizhong (George) Guo
Project Starting Date: 01/01/2007 **Original** Project Ending Date: 06/30/2009 **Modified Completion Date:** Anticipated NCE to 10/31/2009	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Mobilization	1.61%	$ 3,000	0.0%	$ -	100.0%	$ 3,000
2	Pre Literature Search	1.61%	$ 3,000	0.0%	$ -	100.0%	$ 3,000
3	1. LITERATURE SEARCH	6.99%	$ 13,000	0.0%	$ -	100.0%	$ 13,000
4	2. TECHNICAL PANEL	5.37%	$ 10,000	0.0%	$ -	100.0%	$ 10,000
5	3. THREE REGIONS	8.60%	$ 16,000	0.0%	$ -	100.0%	$ 16,000
6	4. REPRESENTATIVE DEVICES	5.37%	$ 10,000	0.0%	$ -	100.0%	$ 10,000
7	5. PRE-MONITORING CLEAN-OUT	5.37%	$ 10,000	0.0%	$ -	100.0%	$ 10,000
8	6. MONITORING AND ANALYSIS	40.31%	$ 75,000	30.0%	$ 22,500	100.0%	$ 75,000
9	7. MAINTENANCE GUIDANCE	6.99%	$ 13,000	10.0%	$ 1,300	10.0%	$ 1,300
10	8. Final Report and Quarterly Reporting	17.78%	$ 33,080	5.0%	$ 1,654	25.0%	$ 8,270
11		0.00%	$ -	0.0%	$ -	0.0%	$ -
12		0.00%	$ -	0.0%	$ -	0.0%	$ -
13		0.00%	$ -	0.0%	$ -	0.0%	$ -
14		0.00%	$ -	0.0%	$ -	0.0%	$ -
15		0.00%	$ -	0.0%	$ -	0.0%	$ -
16		0.00%	$ -	0.0%	$ -	0.0%	$ -
17		0.00%	$ -	0.0%	$ -	0.0%	$ -
18		0.00%	$ -	0.0%	$ -	0.0%	$ -
19		0.00%	$ -	0.0%	$ -	0.0%	$ -
20		0.00%	$ -	0.0%	$ -	0.0%	$ -
	TOTAL	100.00%	$ 186,080		$ 25,454		$ 149,570

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

100 Brett Rd. Piscataway NJ 08854-8058
Tel: 732-445-0579 Fax: 732-445-3325

Project Objectives:

1. Monitor the amounts of sediment, oil, grease, and buoyant debris that would be actually trapped in the stormwater treatment system units installed by NJDOT.
2. Relate the trapped amounts of sediment, oil, grease, and buoyant debris to highway drainage area characteristics.
3. Provide NJDOT with quantitative guidance on the maintenance/cleanup schedule and measures to reduce maintenance/cleanup frequency.

Project Abstract:

To improve the quality of highway runoff and meet the new stormwater management requirements, the New Jersey Department of Transportation (NJDOT) has installed numerous prefabricated stormwater treatment systems throughout the state produced by a range of manufacturers. The use of such systems, known as Manufactured Treatment Devices (MTDs), is expected to continue in the foreseeable future. As the responsible party for the maintenance of these MTDs, NJDOT is interested in determining optimum maintenance intervals and expected maintenance costs for the range of MTDs utilized by the Department. This project will monitor and document maintenance procedures, intervals, and costs for a representative range of MTDs.

1. Progress this quarter by task:

Task 6 (monitoring and evaluation) was completed. The monitoring and evaluation was expanded to include the time period prior to the "pre-monitoring cleanout." Quantification of physical and chemical characteristics of the "pre-monitoring cleanout materials" was completed. Observations about the sites including type and amount of gross solids on the ground, soil type, land use type, traffic volume were completed. The selected and cleaned 12 treatment devices have continued to be monitored including measurements of the sediment and floatables depths inside the devices. The 12-month required monitoring was completed for the last device in this quarter. Other 11 devices were monitored beyond the 12-month requirements.

The engineered and built drainage networks were observed and evaluated. They were compared against the collected paper info such as drainage areas, constructions plans, and calculations.

2. Proposed activities for next quarter by task:

The maintenance guidance will continue to be developed. The draft final report will start to be prepared.

3. List of deliverables provided in this quarter by task (product date):

None.

4. Progress on Implementation and Training Activities:

1) The NJDOT maintenance personnel were involved in the actual cleanout of the devices. The NJDOT maintenance personnel as well as the contractors gained the valuable field maintenance experience.

2) Early observations and suggestions on maintenance accessibility and interval were provided to NJDOT. The NJDOT was suggested to add manufactured treatment devices into the highway database such as the "Straight Line Diagrams," to additionally consider device accessibility during design and construction despite other constraints, and to minimize the amount of gross solids that would enter the devices.

3) A device inspection form was made and provided to NJDOT Maintenance Division for their use.

4) A field trip was organized for the NJDOT personnel to Montgomery County, Maryland on June 5, 2008 to observe their maintenance program on stormwater manufactured treatment devices.

5) Progress of the project and early observations and recommendations were presented at the NJDOT Research Showcase on November 28, 2007 as well as on October 16, 2008.

5. Problems/Proposed Solutions:

After 12 months or more, none of the monitored devices have sediments accumulated to the maximum sediment capacity that require maintenance. It is suggested that NJDOT continues to monitor the devices up to the maintenance maximum in order to determine the actual maintenance intervals.

Year 1 Budget	$186,080
Years 1 & 2 Cumulative Budget	
Years 1, 2 & 3 Cumulative Budget	
Total Project Budget	$186,080
Modified Contract Amount:	$186,080
Total Project Expenditure to date	$149,570
% of Total Project Budget Expended	80.38%

NJDOT Research Project Manager Concurrence: _____ Date: _____

CAIT
Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

Project Title:	Evaluation of Warm Asphalt Technology
RFP NUMBER: 2008-01	NJDOT RESEARCH PROJECT MANAGER: Lad Szalaj
TASK ORDER NUMBER: TO 218 / RU Acct 4-27212	PRINCIPAL INVESTIGATOR: Thomas Bennert
Project Starting Date: 01/01/2008 **Original** Project Ending Date: 12/31/2009 **Modified Completion Date:**	Period Covered: 2nd Quarter 2009

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Mobilization	10.52%	$ 30,000	0.0%	$ -	100.0%	$ 30,000
2	Literature Search	2.88%	$ 8,200	0.0%	$ -	100.0%	$ 8,200
3	Influence of Aggregate Blend Moisture Content	6.96%	$ 19,840	0.0%	$ -	100.0%	$ 19,840
4	Assessment of Compactibility of Different WMA's	6.75%	$ 19,238	5.0%	$ 962	100.0%	$ 19,238
5	Laboratory Sensitivity on the Gyratory Compaction of WMA's	13.11%	$ 37,360	30.0%	$ 11,208	100.0%	$ 37,360
6	Laboratory Specimen Conditioning for Performance Testing	10.33%	$ 29,436	15.0%	$ 4,415	25.0%	$ 7,359
7	Asphalt Binder Grade Selection	16.08%	$ 45,835	15.0%	$ 6,875	100.0%	$ 45,835
8	Use of RAP	12.37%	$ 35,250	15.0%	$ 5,288	25.0%	$ 8,813
9	In-Project Implementation - Field Trials	13.82%	$ 39,390	30.0%	$ 11,817	100.0%	$ 39,390
10	Final Report and Quarterly Reporting	7.20%	$ 20,522	0.0%	$ -	0.0%	$ -
11		0.00%	$ -	0.0%	$ -	0.0%	$ -
12		0.00%	$ -	0.0%	$ -	0.0%	$ -
13		0.00%	$ -	0.0%	$ -	0.0%	$ -
14		0.00%	$ -	0.0%	$ -	0.0%	$ -
15		0.00%	$ -	0.0%	$ -	0.0%	$ -
16		0.00%	$ -	0.0%	$ -	0.0%	$ -
17		0.00%	$ -	0.0%	$ -	0.0%	$ -
18		0.00%	$ -	0.0%	$ -	0.0%	$ -
19		0.00%	$ -	0.0%	$ -	0.0%	$ -
20		0.00%	$ -	0.0%	$ -	0.0%	$ -
	TOTAL	100.00%	$ 285,071		$ 40,565		$ 216,035

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

Project Objectives:

The objective of NJDOT 2008-01, *Warm Pavement Technology*, is to evaluate the different facets of warm mix asphalt production and performance for future use by the New Jersey Department of Transportation (NJDOT). An assessment of available warm mix additives/technologies will be conducted to provide NJDOT with preliminary recommendations for future use. The assessment will be based on Literature Reviews/Interviews, as well as a detailed laboratory and field research program detailed in this research proposal. This includes critical factors during the laboratory mixture design, as well as critical factors during the production and placement of warm mix asphalt. The research project will also evaluate the potential end uses of warm mix asphalt. This includes the typical use in

structural pavements, as well as the potential use for pothole/maintenance mixes that could be used for long haul/long dwell time projects.

Project Abstract:
The research proposal is broken down into a Literature Search and nine major tasks. The research team will evaluate possible modifications to mixture design and analysis procedures for warm mix asphalt. This will be conducted through a literature search and interview process and then using laboratory experiments that address critical areas where hot and warm mix asphalt differ significantly. This includes limits to aggregate moisture, procedure for the selection of WMA and dosage rate, specimen fabrication, binder grade selection, and recycled asphalt materials (RAP). A sensitivity study to provide recommendations as to which WMA's are preferred, as well as to assess the affects of mixture volumetrics after compaction in the gyratory compactor will provide guidance to warm mix additive selection and expected issues with the Superpave volumetric design when using these additives. It is also proposed that a warm mix test trial, designed based on recommendations from the research study, be included as a validation/verification task. It is important to include the field study so a proper comparison can be verified between laboratory and field produced materials. An Implementation Plan at the conclusion of the study will provide a 1-Day Workshop regarding the use of Warm Mix Additives. The workshop will provide procedures and recommendations for warm mix additive selection, mixture design, and quality control procedures. The workshop will be conducted in the state or the art lecture hall facility at CAIT.

1. Progress this quarter by task:

Task 1 – Mobilization (100% Completed)

Mobilization for the project has been completed.

Task 2 – Literature Review (100% Completed)

The Feasibility/Literature Review was submitted to the NJDOT for view and comments and was eventually accepted. The technical working group (TWG) then gave the official OK to continue with the testing program.

Task 3 – Influence of Aggregate Moisture Content (100% Completed)

Task 3 was completed this Quarter and the analysis is being finalized. In summary, the test results indicate that moisture sensitivity (stripping potential) may be an issue when production temperatures are reduced to approximately 270F. This is due to residual moisture remaining in the aggregates from lack of drying. The test results showed:

Hamburg Wheel Track Testing

- Greater levels of stripping potential were found for the higher absorptive aggregates (1.47%) than in the lower absorptive aggregates (0.61%). The worst performing mix, which showed

stripping almost immediately, was the higher absorptive aggregate mix at the 270F temperature. This occurred at both the 3% and 6% aggregate blend moisture level.

Tensile Strength Ratio (TSR)

- TSR showed an immediate decrease unless the samples were dry and mixing at a temperature at 315F. A reduction in mixing temperature or the inclusion of moisture reduced the TSR value by over 25%. This data has only been analyzed to date using the lower absorptive aggregates. Analysis is on-going for the higher absorptive aggregates and should be available for presentation.

Task 4 – Compactibility of Different WMA's (100% Completed)

Based on the Feasibility Study and new technologies introduced to New Jersey (REVIX), the Compactibility Study has been slightly modified. The study will mainly focus on preblended warm mix additives (Rediset, Sasobit, and REVIX) at different percentages. A number of factors will be evaluated to measure workability/compactibility;

- Casola Method (NCHRP Project 9-39, *Procedures for Determining Mixing and Compaction Temperatures of Asphalt Binders in Hot Mix Asphalt*) for determining mixing and compaction temperatures of binder modified with the warm mix additives;
- Rotational Viscosity (current standard for Superpave) for determining mixing and compaction temperatures of the binder modified with the warm mix additives;
- Thin-film rheology – recently introduced to asphalt with the work by Gerry Reinke at Mathy Construction, Thin-Film Rheology gives an indication of the lubrication that occurs between aggregates (i.e. – higher the lubrication, the better compaction).
- University of Massachusetts Workability Device – the workability is measured as a function of temperature and torque resistance during mixing. Unlike the previous two tests, this test is conducted on the mixture itself.
- Marshall Compaction Hammer – constant energy is applied to the mix through a constant weight falling at a constant height to a known number of blows. Previous work by Rutgers University has shown the Marshall Hammer to be sensitive enough to temperature/workability to pick up the influence of warm mix additives.
- Gyratory Compaction – used as a baseline for comparison.

Testing has been completed for the Massachusetts Workability Device, Marshall and Gyratory compaction. The test results are shown below.

At the moment, the Casola Method for mixing and compaction temperatures, is not applicable to warm mix asphalt. Simply, this is due to the equations developed for the analysis. Each equation, mixing or compaction temperature, incorporates a minimum production or compaction temperature that increases as the phase angle of the asphalt binder increases. Unfortunately, the minimum temperatures set in the equations are higher than typical warm mix production temperatures. Therefore, it is recommended that the Casola Method from NCHRP Project 9-39 not be used for asphalt binders containing warm mix additives (i.e. – Rediset, Sasobit, Evotherm 3G).

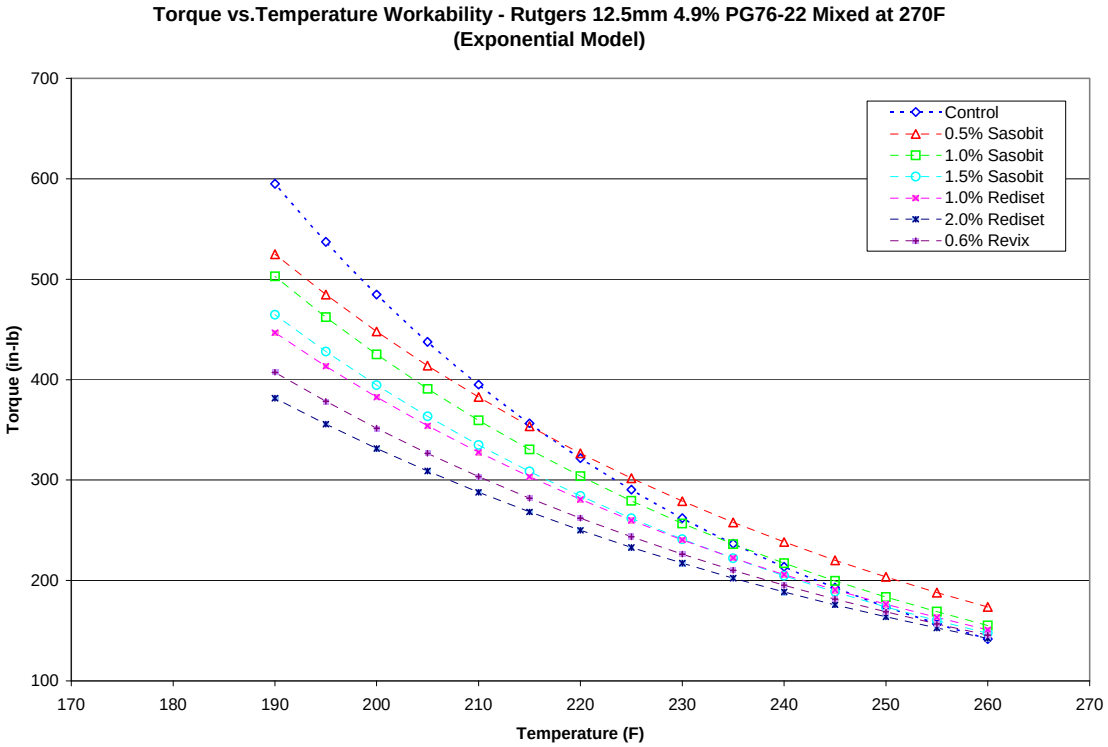

Figure 3 – University of Massachusetts Workability Device Results

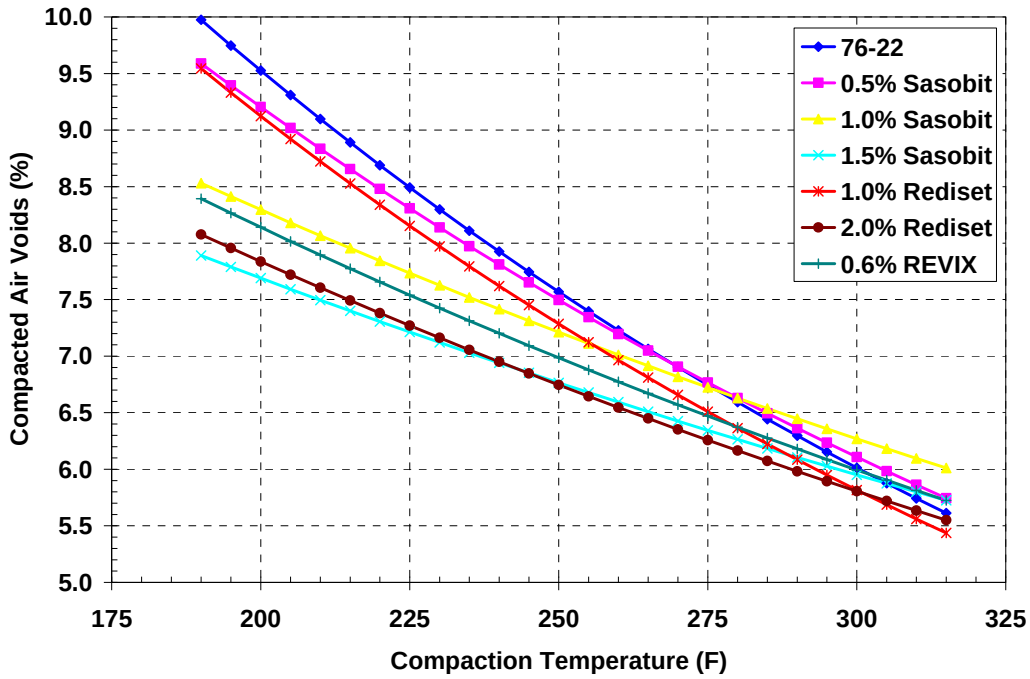

Figure 4 – Compacted Air Voids vs Compaction Temperature – Marshall Compaction

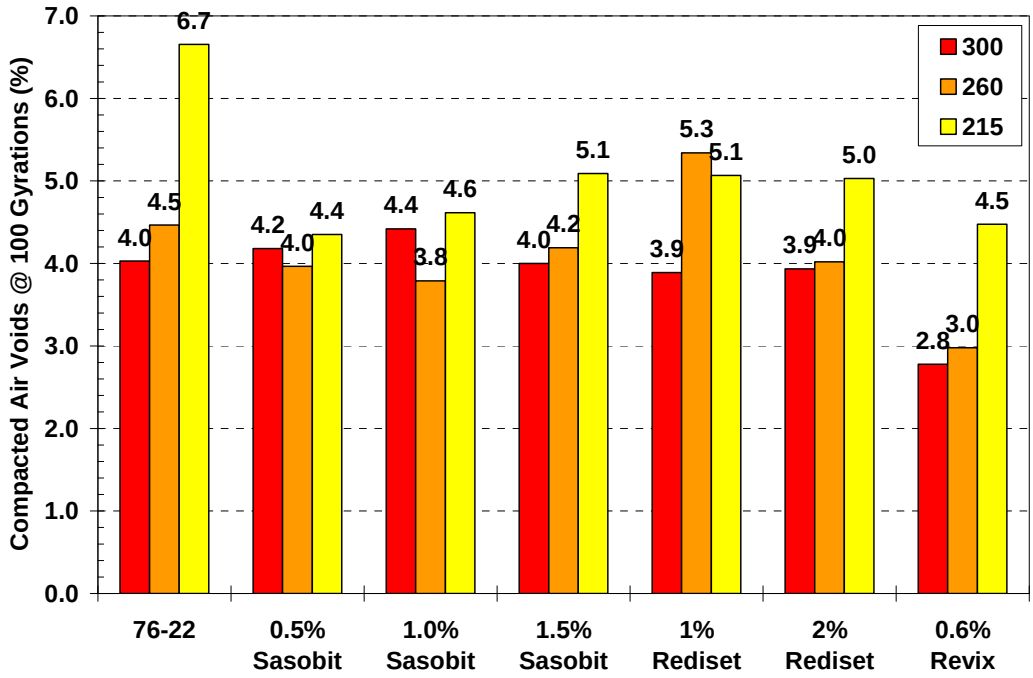

Figure 5 – Compacted Air Voids at Different Compaction Temperatures

The compactibility of the mixture results appears to show differences in ranking depending on the method. Both the UMass Workability Device and the Marshall Compactor show reasonable and logical rankings of the workability/compactibility of the different warm mix additives. A general ranking of the results is shown in Table 1.

Table 1 – Ranking of Warm Mix Additives

	UMass Workability Device		
Best	270F Mixing Temp	320F Mixing Temp	Marshall Compactor
↕	0.6% REVIX	2% Rediset	1.5% Sasobit
	2% Rediset	0.6% REVIX	2% Rediset
	1% Rediset	1% Rediset	0.6% REVIX
	1.5% Sasobit	1.5% Sasobit	1.0% Sasobit
	1.0% Sasobit	1.0% Sasobit	1.0% Rediset
	0.5% Sasobit	0.5% Sasobit	0.5% Sasobit
	PG76-22	PG76-22	PG76-22
Worst			

The test results from Table 1 indicate that using the Marshall Compactor at different compaction temperatures provides similar rankings to the UMass Workability Device.

Data analysis from the Thin-Film Rheology is being completed and Rutgers is awaiting the test results. Specialized testing conducted by Gerry Reinke at Mathy Construction in Wisconsin.

Task 5 – Laboratory Specimen Preparation Procedure (25% Completed)

A majority of the testing will be conducted from the next field trial section. It is required to have plant produced material, along side laboratory produced material, to compare levels of aging (differences to that produced at the plant and that from the lab). However, some samples are being shipped to Rowan University for asphalt binder extraction and recovery work. This will help to verify the aging occurring in the binder.

Task 6 – Asphalt Binder Selection (100% Completed)

Information was provided to Rutgers regarding a proposed compaction temperature limit that is based on the Aging Ratio of the asphalt binder, where the aging ratio is defined at G^*_{RTFO}/G^*_{Orig}. After receiving this information, Rutgers contacted both SemMaterials and NuStar, the two most prominent asphalt binder manufacturers in New Jersey, to obtain the general Aging Ratio information for various asphalt binder grades produced by the refineries. A table of the recommended lower limit for compaction temperature without the need to bump the binder grade has been generated and will be presented at the Quarter Meeting. This proposed table will be evaluated in the laboratory using the Asphalt Pavement Analyzer and Flow Number.

Dynamic Modulus testing showed that on average (i.e. – average for all materials and loading frequencies per temperature):

- 4°C Test Temperature
  - No stiffness reduction found at 270F mixing temp
  - 14% reduction in stiffness at 230F mixing temp
- 20°C Test Temperature
  - 5% reduction found at 270F mixing temp
  - 23% reduction found at 230F mixing temp
- 45°C Test Temperature (Rutting Conditions)
  - 16% reduction found at 270F mixing temp
  - 42% reduction found at 230F mixing temp
- Testing softer binders (PG70-22 and PG64-22) indicated that:
  - 30 to 35% reduction in dynamic modulus at 45°C equivalent to dropping from PG76 to PG70-22
  - 45 to 50% reduction in dynamic modulus at 45°C equivalent to dropping from PG76 to PG64-22

The dynamic modulus testing clearly showed that as production temperature decreases, the overall stiffness of the asphalt mixture decreases due to the general aging that occurs in the asphalt binder. At test temperatures of 4 and 20°C, the amount of stiffness reduction was found to be minimal. However,

reduction in mixture stiffness at intermediate and low temperatures commonly results in greater fatigue resistance, which is obviously not detrimental to the asphalt mixture. At 45oC, which would be the test temperature more critical for rutting resistance, the reduction in production temperature has a dramatic affect on stiffness. Although their exists only a 16% stiffness reduction when reducing production temperatures from 315 to 270F, at production temperatures of 230F, an average of 42% stiffness reduction was measured. When comparing this to the softer asphalt binders tested (i.e. – PG70-22 and PG64-22), a 42% reduction is equivalent to dropping the PG binder by almost 2 grades (i.e. – dropping from PG76-22 to PG64-22).

Flow Number measurements, as determined during the Repeated Load test, indicated that on average:

- A 30% decrease in the Flow Number was found when decreasing the mixing/compaction temperature from 315F to 270F
- A 60% decrease in the Flow Number was found when decreasing the mixing/compaction temperature from 315F to 230F
- Testing softer binders (PG70-22 and PG64-22) indicated that:
  - 60% reduction in Flow Number equates to 1 drop in PG grade (from 76-22 to 70-22)
  - 80% reduction equates to a 76-22 dropping to a 64-22

Similar to the Dynamic Modulus testing, the Repeated Load results showed the influence of production temperature reduction to permanent deformation.

The laboratory results were then compared to plant produced materials that were collected and tested. To compare equally across the board, the reduction in performance (dynamic modulus or Flow Number) was compared to the reduction in production temperature (normal production temperature to warm mix production temperature). The results are shown in Figures 1 and 2. It should also be noted that all plant produced projects had RAP included, with the I78 project actually containing 25% RAP. The plant produced mixes are in line with the laboratory produced mixes, confirming that regardless of mixture type, it is the change in production temperature that influences the mixture stiffening. Based on this concept, it was recommended to NJDOT to limit the "reduction of production temperature" to 55oF in order to maintain the specified PG grade performance. In most cases, this results in limiting the production temperature to a minimum of 260^{o}F.

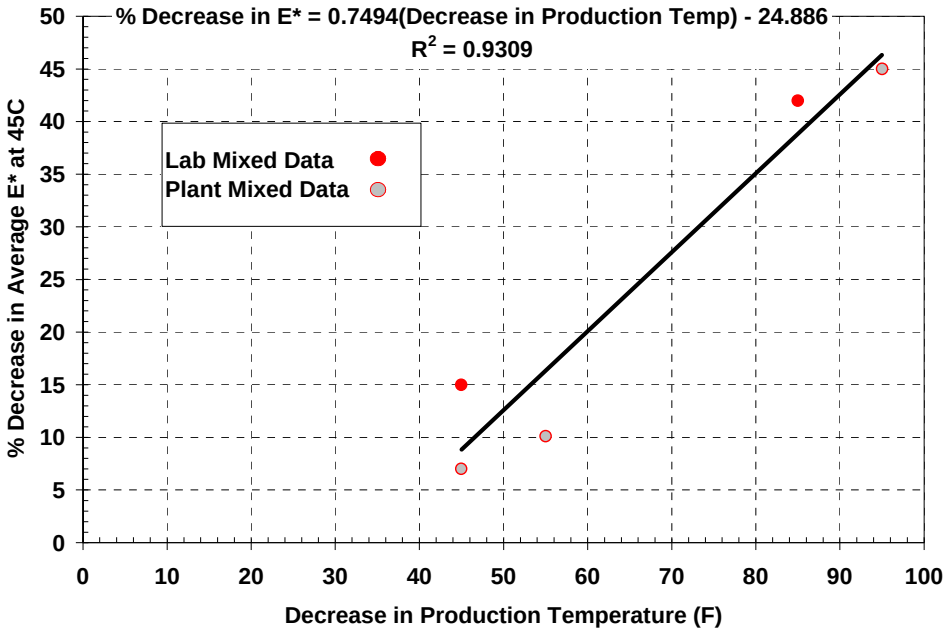

Figure 1 – Decrease in Dynamic Modulus vs Decrease in Production Temperature

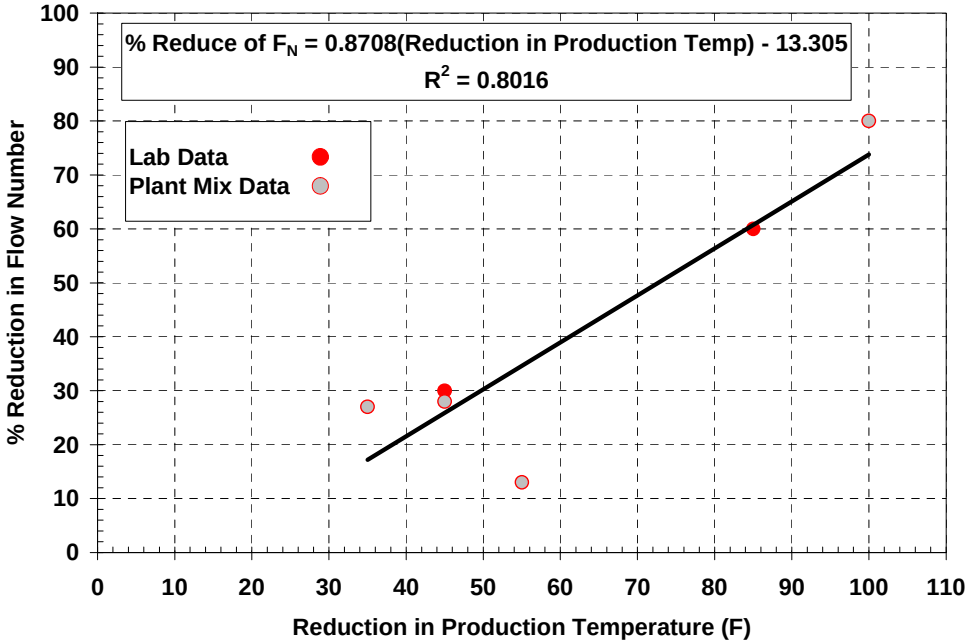

Figure 2 – Decrease in Flow Number vs Decrease in Production Temperature

Task 7 – Use of Higher RAP Percentages (25% Completed)

Different plant produced mixes were provided to Rowan University for extraction, recovery, and master curve analysis.

Task 8 – Field Trials (70% Completed)

Additional field trials are being organized to evaluate some of the foaming type plant systems, as well as additional warm mix additives.

2. Proposed activities for next quarter by task:

3. List of deliverables provided in this quarter by task (product date):

4. Progress on Implementation and Training Activities:

5. Problems/Proposed Solutions:

Year 1 Budget	$166,385
Years 1 & 2 Cumulative Budget	$285,071
Years 1, 2 & 3 Cumulative Budget	
Total Project Budget	$ 285,071
Modified Contract Amount:	
Total Project Expenditure to date	$ 216,035
% of Total Project Budget Expended	75.79%

NJDOT Research Project Manager Concurrence: _____ Date: _____